



National  
Measurement &  
Regulation Office

# National Legal Metrology Project Report 2014/15



## Medical Weighing Equipment



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## 1. Executive Summary

In 2007, LACORS (the Local Government Co-ordinators of Regulatory Services) commissioned a national project which focussed on the availability and use of weighing instruments in hospitals. The project ran over 2008 and 2009 and was very successful in that it showed the value of co-operative working between the Health Services and Legal Metrology Practitioners, and showed improvement in compliance as the project progressed.

Local Authority Trading Standards Officers across the UK worked with their local NHS Trusts to inspect hospital weighing equipment and make sure it was accurate, legal and fit for purpose.

This resulted in a demonstrable increase in compliance supported by joint educative and training material for Health Practitioners.

The Annual Returns under Section 70 of the Weights and Measures Act now give Local Authorities the opportunity to suggest potential National Projects. Last year, aspects of medical weighing were proposed for consideration and these were subsequently agreed by the National Metrology Expert Panel and National Measurement & Regulation Office (NMRO). It was decided that the forthcoming project should be focussed on Doctors' Surgeries, Pharmacies and Health Centres. This decision supports the fact that Public Health is now within the scope of Local Authority responsibility, as is the National Child Measurement Programme.

This project ran from April 2014 to March 2015. 27% of Local Authorities participated in the project, targeting 21% of premises identified as suitable to visit.

Data Analysis of the project results shows the following compliance levels:

Non-Compliance rate – 23%

Non stickered equipment – 12%

Equipment not suitable for patient weighing requirements – 23%

Equipment that carried the required stickers – 59%

What % of premises visited were aware of the recommendations from the previous project – 16%

Because of the significant non-compliance rate this equipment would be rated as very likely to fail with a high risk of impact on the risk matrix contained within the Section 70 Report.

Although 23% is a significant rate of non-compliance, this does mean that 77% are compliant. When compared to the non-compliance rate of the previous project (targeting hospitals) which was 34% in the first round (2008) reducing to 19% in the second round (2009) this level of non-compliance is better than 2008. When this project was agreed there were no plans to repeat it as happened in the earlier project.



## 1.1 NMRO Recommendations.

- Repeat the project to see if compliance rates have improved. When the project is repeated identify if a calibration contract is in place & identify the companies carrying out calibration service for referral to Home/Primary Authorities. We would prefer the follow up project to target those premises previously visited to measure improvement rates as well as identifying new premises to participate.
- Improve knowledge of practice managers/health care professionals at doctors' surgeries using the training aid contained in Annex 1 and Annex 2, and encourage simple daily tests to be completed.
- Improve the quality of calibration contracts obtained by Doctors Surgeries and Health Centres by passing the results contained within this report (including the training aid contained in Annex 1 and Annex 2.) to NHS Supply Chain.
- Encourage medical weighing equipment to be kept to a minimum amount (don't need one in every room) and static, so when you arrive at the surgery/health centre you attend a central point where your weight is checked and logged before you attend the consultant, so one very accurate piece of equipment (class III) is in use instead of many less accurate machines
- NMRO to hold a meeting to invite manufacturers of medical weighing equipment, those offering calibration services, NHS Supply Chain and Trading Standards with the aim to increase knowledge and raise standards within this area.
- Medical Weighing Equipment to be added to the Section 70 Return and as a result listed on the Risk Matrix contained within the Section 70 Report.



## 2. Introduction

For a number of years, Trading Standards Services have taken part in National Metrology Projects. These have been organised to add value to inspectional work which has been done by individual Trading Standards Services as part of their local responsibility. Such work has been undertaken across the United Kingdom on a risk basis and has focussed on a particular subject and has been nationally collated.

This year, following the results of the requested projects published in the Section 70 Report for 2012/13, the National Metrology Expert Panel agreed a project for 2014 / 2015 on Medical Weighing Equipment in locations other than hospitals. This decision was supported by the National Measurement & Regulation Office (NMRO).

A previous National Project over 2008 / 2009 had looked at medical weighing in hospitals with a view to assisting and promoting good practice. The final Project Report which summarised this work highlighted demonstrable improvements that had been made over the course of the project which had highlighted the importance of buying suitable equipment and using it properly.

During discussions at the Autumn Metrology Expert Panel meeting in 2013 it was decided that the project would focus on Pharmacies, Doctors Surgeries, Health Centres and Mobile Health Visitors.

The reasons for identifying these targets are that doctor's surgeries, pharmacies and health centres are relatively independent organisations and do not historically receive many visits from Trading Standards (TS) to inspect weighing equipment. Health centres are often involved in national incentives such as the current obesity drive, and mobile health visitors will use equipment that is regularly transported which could impact on their accuracy.

Both of these scenarios will involve the weighing of infants and babies, and the weights determined may be used to prescribe medication or embark on a course of action which may have detrimental consequences if based on inaccurate information e.g. identifying underweight babies or obese children.

Several supporting factors were also identified which made this an appropriate choice for a national project.

- In January 2012 the Public Health Outcomes Framework was introduced to comply with new local government responsibilities to combine traditional 'public health' activities with other local activities.
- As mentioned above, a previous National Project (the National Medical Weighing Project 2008) identified that there were serious inaccuracies in equipment checked, training provided to staff using the equipment and their perception of the importance of using accurate weighing equipment.
- Following on from this project, LACORS (the Local Government Co-ordinators of Regulatory Services) issued a series of recommendations for Hospital Trusts.



## National Measurement & Regulation Office

- The UK Weighing Federation (UKWF) identified that 65-70% of the market that supplied medical weighing equipment were members of UKWF and these business would be keen to be involved in any projects that improved standards within the industry.

These factors made this an ideal example of how joint working between Government (NMRO), Local Government law Enforcement (TS) and Business (UKWF) could combine to improve standards to benefit the wider community.

It was also felt that it would be interesting to compare the results of this project with those from the previous 2008 project to identify if standards have improved. Although these projects did target the same weighing equipment it was being used in a different areas, i.e. doctors surgeries/health centres in 2013/14 and hospitals in 2008/9.

As background information, there have been two recent articles published supporting this subject as a choice for a national project. TS Today Oct 2013 published an article by Richard Sanders “Weight of responsibility” and Royal College of Nursing “The use, limitations and risks associated with weighing devices” was published in November 2013.



### 3. Project Process

Due to the complicated and increasing demands faced by the targeted population of the project in the current climate of reduced resources guidance was given on the best approach to make to gain access to equipment:

- Identify all appropriate premises that could participate in the project.
- Standard letter to be issued by Trading Standards to all suitable premises explaining the remit of the project, why it is being carried out and that an Officer will be in contact to make an appointment.
- Officer to identify the number of premises available resources will cover, (ideally 50% of total) but whatever their resources will stretch to.
- Officer should then make appointments for visits to the Premises to carry out inspections of the weighing equipment, checking for accuracy, suitability etc. Unannounced visits were not recommended due to the amount of disruption that will be caused and the effort needed to carry out the visits.
- Standard advice was issued to staff regarding the use of weighing equipment and appropriate equipment to use.
- Where problems were found extensively in an area then advice is to be offered to both inspected and uninspected premises

It should be noted that the emphasis of the project was of an educational rather than a punitive approach where inaccurate equipment was found as this had proved particularly effective in the previous project carried out in hospitals.

NMRO also saw this as an opportunity to improve competence in respect of this rarely inspected type of equipment within Trading Standards, and in order to achieve this provided a series of free training sessions to all participating Local Authorities across the UK. These were held in London, Scotland and Northern Ireland. As part of this a DVD is also available via the NMRO website free of charge covering Medical Weighing Equipment available to all.

<https://www.gov.uk/government/news/medical-weighing-equipment-video-basic-introduction>

The equipment used to make this training aid was kindly provided by Richard Black of Marsden Group, NMRO would like to thank them for their generous loan of equipment without which this training guide could not have been produced.



## 4. Project Objectives

The project had a number of objectives it sought to achieve; they are listed below:

- To establish and improve partnership working between Local Authority Trading Standards departments and NHS Surgeries and Health Centres.
- To assess current standards of weighing equipment in this sector.
- To make achievable recommendations for improvement leading to measurable gains in patient care.
- To address Local Authorities' local agendas in respect of Public Health, and the National Child Measurement Programme.
- To raise the profile of legal metrology in this sector of Medical Practice.
- To identify which if any of the recommendations from the previous project have been put into practice.

When reviewing the success of the project it was felt that all of these objectives had been achieved:

- Where a Local Authority (LA) participated in the project contact, was required to be made between Trading Standards (TS) and those responsible for Public Health within that LA. Both areas are now aware of the others existence and how the legislation covering this equipment affects them. This relationship can now be used to facilitate further education and training relating to the use and accuracy of medical weighing equipment within the target premises.
- The non-compliance rate of 23% was identified, and this equipment is highly likely to fail with a high impact of that failure.
- At those premises that TS attended, educational material (Annex 1 and Annex 2) has been left to allow practices to better assess the quality of the service they are receiving where a calibration service is already being used, and to encourage the use of a calibration service or TS to calibrate equipment on an annual basis. This report highlights concerns raised regarding the quality of calibrations provided by some businesses as well as the non-compliance rate of 23% which will be disseminated to NHS Supply Chain, with the aim of improving the calibration service procured by the NHS.
- Where premises were visited, equipment tested and educational materials distributed, staff will have a wider awareness of the effect inaccurate or inappropriate weighing equipment can have when considering bad practices (e.g. the use of equipment in inappropriate circumstances), medical issues or prescribing medications.
- Only 16% of the premises visited were aware of the previous project so we can now estimate that the other 84% now have a greater awareness of the legislation relating to medical weighing equipment and the importance of accurate equipment which can be achieved through a quality calibration service. One LA targeted GP surgeries that were within areas identified by the local health authority as having a high level of weight related issues. As 21% of identified premises were visited then awareness of legal metrology has increased by 21%.
- Of the 16% of premises that stated they were aware of the previous project 88% had implemented some of the recommendations made; this supports the effectiveness of an educational based approach towards enforcement of the legislation in this area.



## 5. Results

When LAs were first invited to participate in the project 39% expressed an interest, however when results were submitted participation had dropped to 27%. In the project brief it was requested that LAs targeted at least 50% of the premises identified as suitable to participate, however as the project progressed it was recognised that diminishing resources within LAs and day to day operational commitments of TS meant this figure was no longer achievable. It was therefore recognised that NMRO could only request that LAs committed what resources were available.

Analysis of the results has produced the following statistics:

Percentage of Local Authorities that participated in the project – 27%

Percentage of identified premises that were targeted – 21%

Non-Compliance rate – 23%

Non stickered equipment – 14%

Equipment not suitable for patient weighing requirements – 23%

The percentage of premises visited that were aware of the recommendations from the previous project – 16%

LAs identified a common concern which it is believed significantly affected the accuracy and suitability of medical weighing equipment found in doctors surgeries and health centres, which was the quality of the calibration service they were receiving. Medical professionals often perceived the calibration companies as being experts in the field when in fact the testing of medical weighing equipment was an 'add' on to the servicing of other medical equipment. Because of this the calibration companies (often not the suppliers) could not identify unsuitable or non-prescribed equipment, did not necessarily check the accuracy of equipment up to the maximum weight, and did not necessarily carry out a suitable range of tests on equipment. Medical professionals lacked basic knowledge to identify if they were receiving a quality calibration service or to check the ongoing accuracy of equipment.

27% of the LAs that participated identified the presence of inadequate calibration contracts, 5% of the LAs could identify inaccurate equipment that had recently been tested. 5% of LAs identified premises that did not have any calibration contracts in place. These numbers could be significantly more as this information was not requested with the results, therefore LAs would not have automatically recorded it when attending surgeries and health centres, or reported this information back to NMRO.

While it is recognised that equipment could very quickly become inaccurate through general wear and tear, even with a suitable calibration contract, if the quality of these contracts could be improved or the knowledge of the Practice Manager could be improved then there would be significant improvements made in the calibration of medical weighing equipment, and subsequent continued accuracy of equipment.



Some areas of good practice were identified:

- Where equipment was calibrated using appropriate tests and weights, equipment was taken to a central area where testing 'en mass' took place. TS attended on one of these days and found the quality of the calibration to be to a good standard.
- Where limited resources were available for TS to attend surgeries and carry out testing one LA was able to identify, through the local health authority surgeries, where the highest proportion of weight related issues had been identified.

A number of other issues were also identified:

- 13% of authorities identified that some practices were still using bathroom scales, which can only be used if they are not being used for a schedule 3 purpose. (Schedule 3 Non-Automatic Weighing Instruments Regulations 2000).
- Many surgeries were reluctant to part with switchable equipment (imperial/metric). These present a potential danger if there is confusion between units.
- GP's surgeries are independent and therefore not aware of NHS estates/facilities alerts which provide advice on suitable equipment.
- Medical staff were not aware of the need to check the temperature range at which an instrument is designed to be accurate.
- Lack of the use of levelling devices by maintenance staff, Medical Professionals often not being aware of the importance of a level floor and machines lacking level indicators.

## 5.1 NMRO Recommendations

- Improve knowledge of practice managers/health care professionals at doctors' surgeries using the training aid contained in Annex 1 and Annex 2, and encourage simple daily tests to be completed.
- Improve the quality of calibration contracts obtained by Doctors Surgeries and Health Centres by passing on the results contained within this report including the training aid contained in Annex 1 and Annex 2.
- Encourage the number of medical weighing machines to be kept to a minimum, possibly not needing one in every room, and permanently located where possible, so when patients arrive at the surgery/health centre they attend a central point where their weight is checked and logged before they attend the consultation. One very accurate piece of equipment (class III) is in use instead of many less accurate machines.
- NMRO to hold a meeting to invite manufacturers of medical weighing equipment, those offering calibration services, NHS Supply Chain and Trading Standards with the aim of increasing knowledge and raising standards within this area.
- Medical Weighing Equipment to be added to the Section 70 Return and as a result listed on the Risk Matrix contained within the Section 70 Report.



## 6. Local Authority Participation

As previously mentioned 27% of Local Authorities participated in the project, (54 out of a possible 202)

Regional participation was as follows

<b>Region</b>	<b>Numbers of LA participating</b>
Scotland	15
North East	5
North West	4
Yorks & Humber	6
East Midlands	2
West Midlands	2
Wales	4
East of England	1
London	6
South East	7
South West	1
Northern Ireland	1



## 7. Other Stakeholders

This project was only made possible through the participation of various stakeholders; NMRO would like to thank them for their participation in this project:

Trading Standards who completed the testing and provided training and advice to doctor's surgeries and health centres on behalf of NMRO.

NHS Supply Chain who have agreed to assist in disseminating the results with the aim to improving procurement contracts.

NMRO training who provided trainers to deliver the training programme.

Marsden Group, who provided equipment to assist with the delivery of the training programme.

UKWF for their support for the project.



## 8. Case Studies

### Case Study 1

LA A participated in the 2013/14 medical weighing project. The Regional Metrology Group had previously run a project aimed at Doctors surgeries in 2012 when 7 out of the 12 LAs participated, as well as 8 out of 12 LAs participating in the 2008/9 LACORS National Medical Weighing Project. During the 2013/14 project they came across a scenario which impacts alongside the current medical weighing project in health centres and doctors surgeries.

They were approached by staff from the local health trust medical electronics department which covers the hospitals and some of the health centres scales, which had become aware of the current project from those health centres they engaged with. Up until now the Trust had employed a local repair company to carry out annual certification tests, and then repairs/replacements as necessary, but had terminated that contract and instead, were employing members of their own staff to carry out the annual testing themselves, having acquired certified test weights and assistance from one of the scale suppliers who specialise in medical scales.

They asked for LA A's advice in this and it had been given. The officer involved takes up the story.

To aid their question 'what do I consider suitable tests are?' I drafted a protocol and test sheet for discussion and trial which they considered and agreed to use.

If the activity being taken in-house spreads around, or if in fact it already has, it seems appropriate we have common expectation of such activity. I am aware from the regional project which was conducted in 2012, that there are firms who provide certification services to Doctors surgeries certifying various equipment, including scales, where the staff are not formally trained in testing scales, nor are they engineers in their own right. I was aware at the time of one such business having recently been discovered performing such services which appeared to be less than adequate. If the NHS decide to provide their own in house testing and maintenance programme this may address two of the issues identified throughout the various projects, National and Local, which have been conducted so far:

- Improved quality of calibration and maintenance contracts
- Improved knowledge amongst health care professionals on maintaining and checking accuracy of medical weighing machines

The draft protocol & test form produced was adopted, and LA A is maintaining a relationship with the medical electronics staff, ready to offer further advice and guidance.

Opinion of the officer involved:

I think it must be recognised that we do not expect such services to be of a standard of which we would expect from Inspectors of Weights and Measures or from the Weighing Equipment Trade involved in the verification of instruments; but there should be a minimum level of test which is worthy of certification services, so this is one proposed method of achieving that aim. This may also save the NHS money in the longer term as well as increasing knowledge in this area.



The medical electronics staff at the local hospital have been engaging with other trusts in the region to share their experiences of providing these services “in house”; in today’s climate, routine inspection of such equipment is unachievable, but engaging with the services who perform the routine testing of such equipment is. By proposing model service standards and protocols Trading Standards Services can influence the condition and accuracy of the equipment to the benefit of the general public.

## Case Study 2

As part of the national legal metrology project, Weights and Measures Inspectors from a Local Authority (LA B) inspected a number of medical centres during 2014. Amongst those visited, one particular premise highlighted an issue regarding the standard of calibrations used by private companies who have been contracted to service their weighing instruments.

Each of the thirteen scales on site had a capacity of at least 150kg. Records produced by the surgery showed that Company A had been contracted to calibrate the machines. The last calibration report, dated 22<sup>nd</sup> November 2013, identified only ten machines that had been tested, all of which were identified with the Company’s own serial number rather than the serial number on the data plate of the instrument. This made it unnecessarily difficult to trace the calibration work that had been performed.

All weighing instruments calibrated had only been checked up to 80kg i.e. barely half the capacity of most of the machines. Given the current UK statistics showing that almost two thirds of men and women are either obese or overweight, it was felt that by terminating the calibration at this amount it would not be reflective of the patient weights actually being determined on the scale and would therefore be inappropriate.

On testing the Non-automatic Weighing Instruments, three of the thirteen (23%) fell outside of permitted tolerances, including one that was more than twice the prescribed limit of error. Of these three, one was a particularly critical machine used in the nurse’s room. Significantly, all three were still within tolerances at the highest weight applied by the calibration company.

As a result, all three were taken out of service and the matter reported to colleagues at LA A to discuss with the Calibration Company.

Local Authority C takes up the story following the referral from LA B and a further referral from LA D.

Myself and a colleague visited Company A where we met with the Owner and Sales Director. Over the course of the meeting we had a frank discussion which I introduced by explaining the idea behind the surgery project and some historical background. I also went through the draft results and recommendations which they were particularly interested in. One result they would have liked to see was the proportion of digital equipment that was found to be incorrect rather than equipment as a whole.

I also discussed the two referrals we had received as part of the project which prompted a discussion on the tests applied and the recording of the tests. One of the criticisms about the calibration



reports was the fact that they do not record the serial number of the instrument, rather an ID number. Although they argued the serial number was difficult to find I explained in many cases, certainly where the equipment is stamped, the serial number is located on the data plate so can be easily found and read. They will consider recording this information in the future, although they mark their calibration sticker with their reference number so the exact instrument could be identified if necessary.

The tests they undertake are to exercise the instrument by the tester standing on the scale, load it to either 80Kg or 90Kg and then carry out a type of eccentric testing as appropriate. If the instrument falls outside the limits of error it would be marked as a fail and a reason would be provided on the certificate. Additionally the staff would be made aware of a failure. Company A cited occasions where they have returned for the next calibration visit only to find the equipment back in use. This is a situation we have also come across on numerous occasions. I provided company A with information published by the UKWF which cited the recommended minimum tests that would in the UKWF's opinion be suitable. UKWF recommend testing the equipment to plus 10% of its normal working range for the purposes of a calibration.

We discussed the sort of tests that Trading Standards would apply and this led onto a discussion which I feel lies at the heart of this subject. The calibration companies are competing with each other for business. Company A would be open to having his staff perform more rigorous tests on the equipment however this will increase the price of the calibration. In his opinion this will undoubtedly lose them business to their competitors unless their competitors also agree to more robust testing, increasing their costs, but ensuring a consistent testing regime for weighing equipment in surgeries.

Furthermore, company A highlighted the difficult financial position the surgeries are in which prompts them to look for both low cost calibration and low cost equipment which they perceive to be value for money but might not necessarily provide them with the best equipment for the task. Were a calibration company to increase the cost of calibrations, for valid reasons, it is the company A's opinion that they will simply look elsewhere for a cheaper option. This is evidenced in the fact that the most popular weighing instruments in surgeries appears to be an analogue scale which is often Class III, and are the cheapest scale for surgeries on the market. In my experience these are the scales that were most likely to fail testing, thereby potentially being more expensive over time. We discussed the tolerances applied and company A had a good understanding of the tolerances to use based on the scale division. The scale has a scale division of 1kg in the majority of cases. The MPE's are therefore 1Kg, 2Kg and 3Kg depending on the load applied. Company A however will only apply an error of 1Kg regardless of the loads, as in his opinion the errors were too large. This is contrasted by what we were often told by the Surgeries that the permitted errors were too small for their purposes. Company A raised a novel idea that the errors should be percentages rather than discrete figures, similarly to liquid fuel, however he accepted that the errors to use are those in the legislation.



Finally company A was enthusiastic about attending a meeting at NMRO to which all interested parties would be invited, but felt that it would only work if all parties attended and with the hope that agreement could be sought such that one company was not putting itself at a commercial disadvantage. Bearing in mind the historical habit of using a Class III weighing instrument in surgeries which would usually only be recommended for use to weigh sand and ballast, I would wholeheartedly agree with Company A's opinion that it is important for the manufacturers to also attend the meeting.



Double click to play slideshow

# Weighing Patients in a Surgery or Health Centre

## Self- Teach and Test



## Annex 2 – NHS Alert

Double click on document below to read content

### Estates and Facilities Alert



#### Action

Ref: EFA/2010/001 Issued: 15<sup>th</sup> March 2010 at 14.00  
Gateway Reference: 13924

Device	
MEDICAL PATIENT WEIGHING SCALES	
Problem	Action
Medical weighing equipment used in healthcare premises may be inaccurate, inappropriate or not used correctly, leading to potential errors in diagnosis, treatment or medication of patients.	Healthcare providers should review the LACORS (Local Authorities Coordinators of Regulatory Services) final report, published in July 2009, and draw up an action plan to address the report recommendations where they consider a risk to patient safety may exist.
Action by	Contact
Chief Executive/Board Member with special responsibility for health and safety, in accordance with local procedures, should ensure that this alert is brought to the attention of appropriate staff.	Further advice can be obtained from LACORS (Local Authorities Coordinators of Regulatory Services), local Trading Standards Departments, or the UK Weighing Federation.  Website details can be found on page 2 of this alert.



## Annex 3 – In house testing of Weighing Machines

Double click to read document

### Testing scales found in use in hospitals/health centres/doctors surgeries.

The purpose of in-house testing is to discover if equipment remains fit to continue in use, or if equipment requires replacement, or repair to correct any faults or errors which it possesses; whilst the recommended tests are influenced by the applicable standard BSEN 45501, it is not designed to replace tests carried out by manufacturers or repairers.

Note: there is specialist equipment which requires greater expertise in testing, such as those built into beds, or slings used to lift patients and weigh them during the lift; this guide is not suitable for such equipment, nor should it be used in any circumstances for high dependency equipment for new-born babies; such equipment requires expert evaluation.

Three items influence the conduct of the test;

1. The capacity of the scale
2. The size of the scale division. [This usually appears in the form  $d=Xg$ ]
3. The class of the scale – class III(3) or class IIII(4)

These are usually marked near the indicator. [There will also be a value for “Min” or minimum load the scale should be used for].

There should also be a dataplate which bears the verification marks and a symbol ‘ $e=Xg$ ’. This mark reveals something called the verification scale interval, which is used when testing for the first time, or following repair. In most cases ‘d’ will be the same as ‘e’. For the purpose of in service testing use the value ‘d’.

Test weights required;

A weight equal to  $\frac{1}{2} d$ , [this can be a problem where weights equal to this figure are not available – you cannot buy a 2.5 g weight where  $d=5g$ , nor a 25g weight where  $d= 50g$ ; you can however use 2 x 2g and 1g, and 20g and 5g which together equal the required amount.]

A weight equal to d,

A weight equal to the minimum value,

Test weights to the value of Maximum.

The errors allowed are laid down in the regulations; for ‘in service’ instruments, for class III(3) instruments they equate to;

Range 1: 0 – 500 divisions, which is 1d

Range 2: 501 – 2000 divisions, which is 2d

Range 3: 2001+ divisions, which is 3d

In many cases, max will be equal to or less than 2000 divisions so 3 division’s error will not apply at all.

The chart below should assist:



National  
Measurement &  
Regulation Office



National Measurement and Regulation Office  
Regulation Directorate  
Teddington  
Middlesex  
TW11 0JZ  
General Enquiry Line: +44 (0)20 8943 7272  
Email: [info@nmro.gov.uk](mailto:info@nmro.gov.uk)  
Website: <http://www.gov.uk/nmro>